

## Section 12

### Engine, Torque Link and Clutch

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#### Procedures covered in this section:

Install upper engine mount cup; install engine; fit and install torque link; assemble and install idler arm, idler pulley, clutch tube and electric actuator; tension main drive belts.

#### Cards used in this section:

E13 CARD 1T (engine mount)	E24 CARD 3T (engine/exhaust)	E27 CARD 3T (electric clutch)
E24 CARD 1T (exhaust)	E27 CARD 1T (electric clutch)	E27 CARD 4T (torque link)
E24 CARD 2T (engine)	E27 CARD 2T (electric clutch)	

#### Prints used in this section:

E27-2000                      E49-2001  
Electrical

#### Templates used in this section:

E13-1 Engine Shims      E27-1 Microswitch Bracket

#### Tools required for this section:

Air or electric drill	Floor jack or	Metal cutting snips	Spring scale
Allen wrench 1/4"	scissors jack	Pliers	Straight edge
Band saw	Grinder	Pop rivet gun	Tap: 5/16-24
Dial calipers	Level	Ruler	Tap handle

Drill bits of the following sizes: 1/8", 5/16", 7/16"

Ratchet with sockets of the following sizes: 1/4", 5/16", 3/8", 7/16", 1/2", 3/4", 11/16", 7/8"

Wrenches of the following sizes: 1/4", 5/16", 3/8", 7/16", 1/2", 3/4", 11/16", 7/8"

#### Notes:

1. ENGINE: Before beginning any work with the engine, make sure the exhaust port holes have been taped over with duct tape. If this is not done and a washer or other object is accidentally dropped into the exhaust port, you will run the risk of damaging a valve the first time the engine is started.
2. LOWER ENGINE MOUNT SHIMS: Determine if the engine should be shimmed up or down and cut out the appropriate shims. (Refer to Section 3.)
3. CLUTCH: It is important for the centerline of the clutch idler pulley shaft to be parallel to that of the secondary shaft in both the fore and aft and lateral planes. The height of the idler pulley should be adjusted so that it is centered on the secondary drive pulley.
4. TORQUE LINK: Leave enough thread in the rod end for future adjustment.
5. TAIL BOOM SUPPORT: The tail boom support brace tubes can be removed from the airframe for easier installation of engine. BEFORE REMOVING THESE TUBES, BE SURE THAT THE TAIL BOOM IS REMOVED OR PROPERLY SUPPORTED, OR DAMAGE TO THE AIRFRAME WILL RESULT. Support tubes must be reinstalled before engine height measurements are taken.



## **ENGINE INSTALLATION**

### **Photo #1**

Use print E27-2000 (clutch) and template E13-1 (engine shims) when installing the A600 engine assembly.

Parts as received from RotorWay.



### **Photo #2**

Fit the rubber strip so it covers the machined area on the inside of the upper engine mount cup. Glue the rubber to the cup with the 3M 2 part epoxy adhesive, also called "blade glue". Rivet the rubber strip in place, using 1/8" washers on both pop rivets.

Note: Rough up the inside surface of the upper engine mount cup. This will help the glue adhere to the cup.  
Parts found on E24 CARD 1T and E24 CARD 3T.



### **Photo #3**

The cup is shown here bolted to the clevis for a better understanding of how they fit together.





**Photo #4**

There should be a 1/8" gap (approximately) between the rear of the upper engine mount clevis and the bottom of the square drive mount tubes. (See also Section 11 Photo 3.)



**Photo #5**

Place the engine mount support ring on a scissors jack and set the engine in it vertically, in a manner that will not allow it to slip off. See note in Section 3, Page 4, Photo #5. The jack should be raised to a height of about 15". Have someone help you hold the engine; a drop to the floor from this height could cause considerable damage to the engine.

Note: Place the 4 main drive belts (E23-1215) over the top of the engine pulley while installing the engine.

Note: Clean main drive belts with acetone before installation to remove mold release agent. Use a damp rag with acetone and clean until no more black material can be removed on a clean cloth.



**Photo #6**

Place the upper engine mount cup into the main drive pulley mounted on top of the engine. Rotate the upper drive cup in the pulley so that the half moon (arrow) is toward the front of the engine (the sharp edges can cut the rubber on the upper cup if not turned forward).

Note: Although similar in size, the round boss on top of the drive cup is not supposed to fit inside the hole in the engine mount cup. When installed, the only point of contact between the two pieces should be the rubber lining.

**Photo #7**

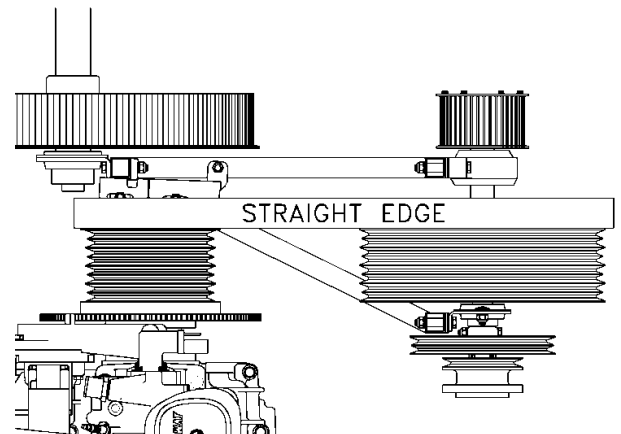
On the engine pulley, note that the distance from the top of the uppermost groove to the top surface is .200" greater than that of the secondary pulley. If the engine was installed with the top of the engine pulley at the same height as the top of the secondary pulley, the drive belt would be .200" lower at the engine pulley. For future alignment, place a piece of masking tape on the engine pulley as shown and mark a reference line .200" below the top. Raise the engine until the upper engine mount cup fits into the clevis. Install the three 5/16" bolts that hold the engine mount support ring to the engine mount weldment (print E13-2000).



**Photo #8**

Check the alignment of the secondary pulley and the engine pulley. The straight edge should make contact with both sides of the secondary pulley and align with the mark on the masking tape that is .200" from the top of the engine pulley. Use shims on the lower engine mount to achieve the proper alignment, by either raising or lowering the engine. Refer to Section 3, Photo #4. Template E13-1.

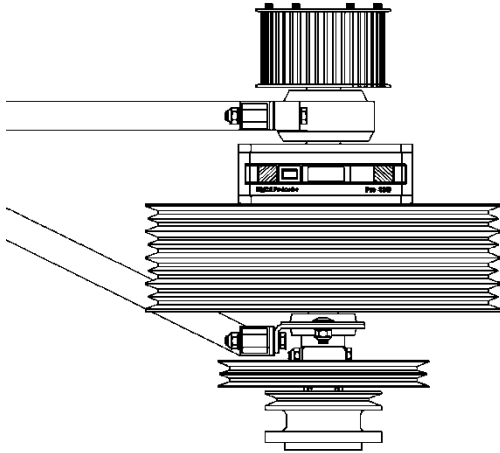
Note: Make sure that the engine is sitting on top of the rubber ring. If there is a space between the ring and the engine you will have to trim the rubber ring.



**Photo #9**

The main drive belts can be adjusted with a light tension. Correct tension will be done at the end of the build. (Section25).





**Photo #10**

Place a level on the secondary pulley and shim under the skids until the level reads zero fore/aft and laterally.



**Photo #11**

Place a level on the engine flywheel to check the fore and aft level. Move the top or bottom of the engine until the bubble centers.



**Photo #12**

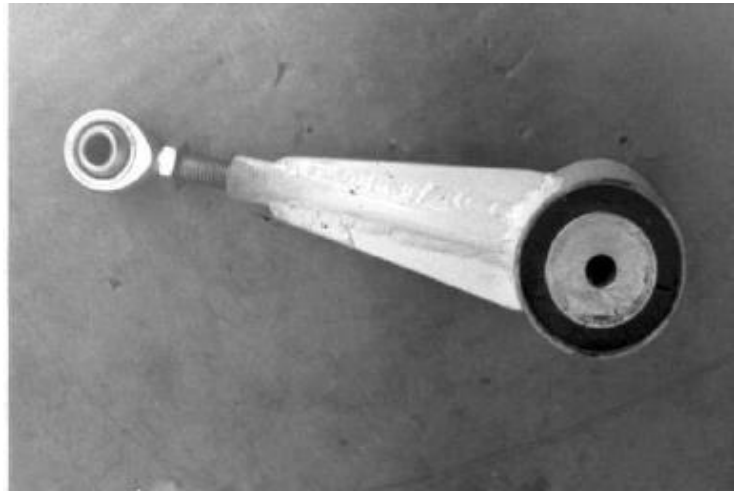
Check on the pilot side to see that the valve cover drain does not hit the frame. The engine may be rotated by adjusting the torque link.

## **TORQUE LINK**

### **Photo #13**

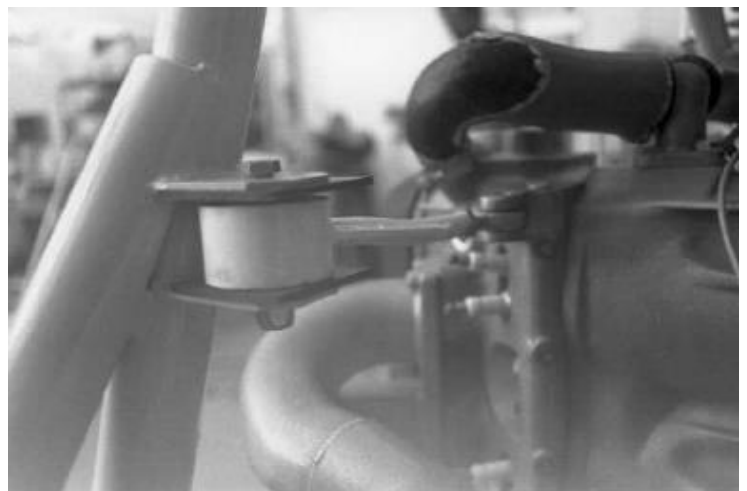
Tap the arm of the torque link with a 5/16-24 tap and assemble it as shown on print E27-2000. Parts are found on E27 CARD 4T.

**Note:** Normally you will have to shorten the arm before tapping.



### **Photo #14**

Fit the torque link to the frame mount by grinding off the top or bottom of the weldment. You can control the height of the arm by trimming one side or the other. When the engine is at the rear of the slots in the mounts, the rod end should not be screwed all the way into the torque link arm. It may be necessary to shorten the torque link as the engine is moved forward to achieve proper belt adjustment.



## **IDLER ARM AND CLUTCH TUBE**

### **Photo #15**

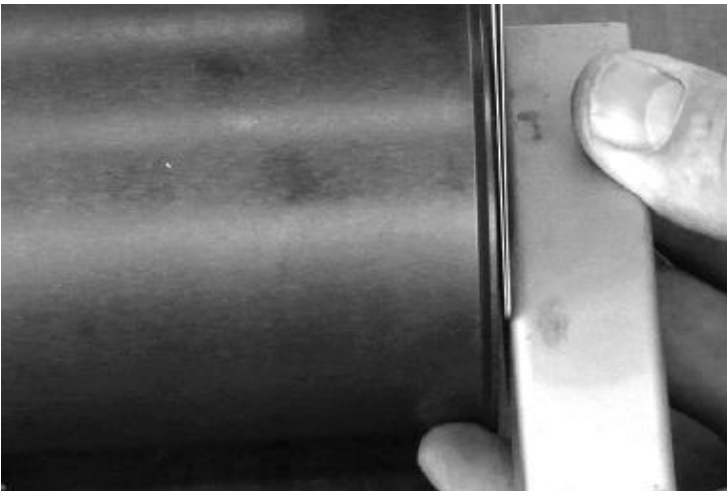
One of the 1/2" washers (E27 CARD 3T) supplied with the idler arm is chamfered on the inside diameter to clear the radius on the idler arm spindle. Install this chamfered washer first. Additional washers may be added after this one to adjust pulley height and clearance (print E27-2000).





**Photo #16**

Install the idler pulley assembly on the idler arm spindle, using another 1/2" washer under the nut. Carefully torque the nut to 12 foot pounds. Do not over torque this nut or it could reduce the internal clearance of the bearings, which will cause them to run hot. On final installation, use Loctite on the nut.



**Photo #17**

Ensure that there is at least .025 inch clearance between the idler arm and the rim of the pulley on top, and the same clearance on bottom between the pulley and the 7/16" brace tube. Clearance and height of pulley can be adjusted by adding washers on the spindle.



**Photo #18**

Install the Nylatron (plastic) bushings and the steel pivot spacer in the idler arm.



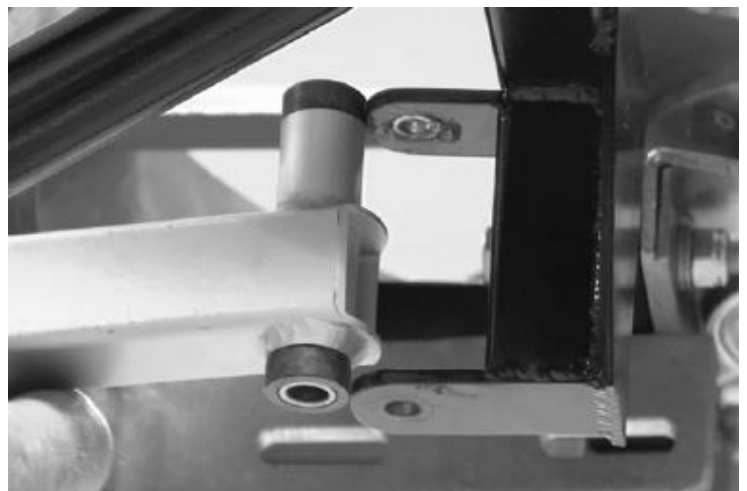
**Photo #19**

To determine pulley height, lightly clamp a straight edge to the secondary pulley. At the correct height, the idler pulley will be centered on the secondary pulley



**Photo #20**

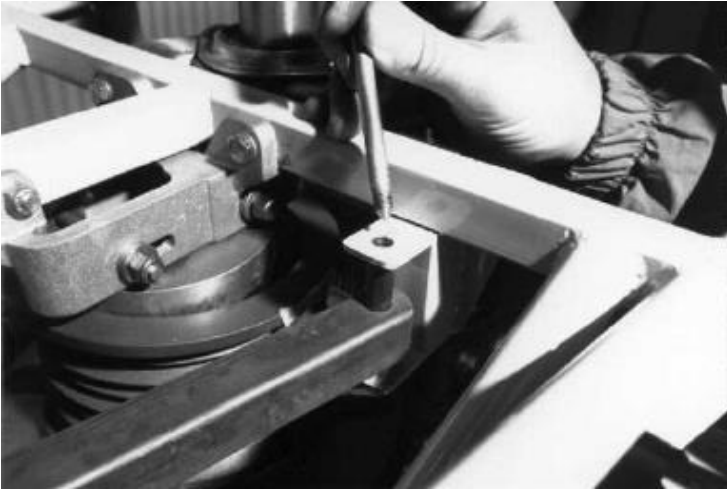
To adjust the pulley up or down, grind off the top or bottom of the bushings and pivot spacer as needed. The ends must be ground squarely (90 degrees) to the hole. After grinding, the bushings must fit snug in the airframe bracket without any end play. Caution: The inner pivot spacer is a precision fit. Be careful not to mar the surface or distort this spacer.



**Photo #21**

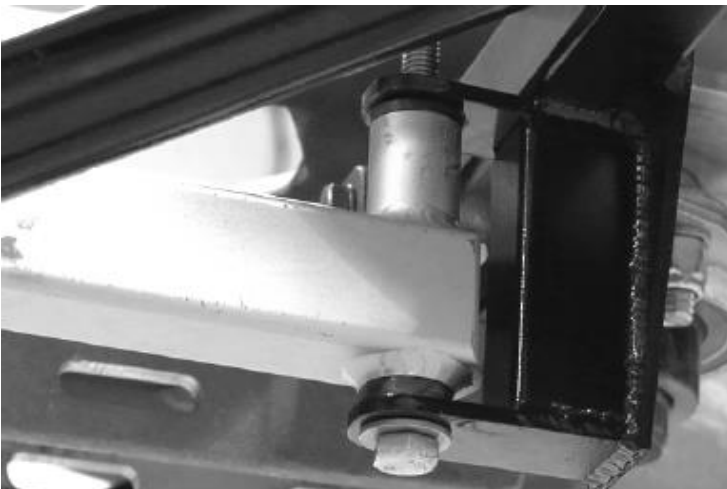
When the correct fit is achieved, trim the Nylatron bushings so that the total length is about .005 inch less than the length of the inner steel pivot spacer.





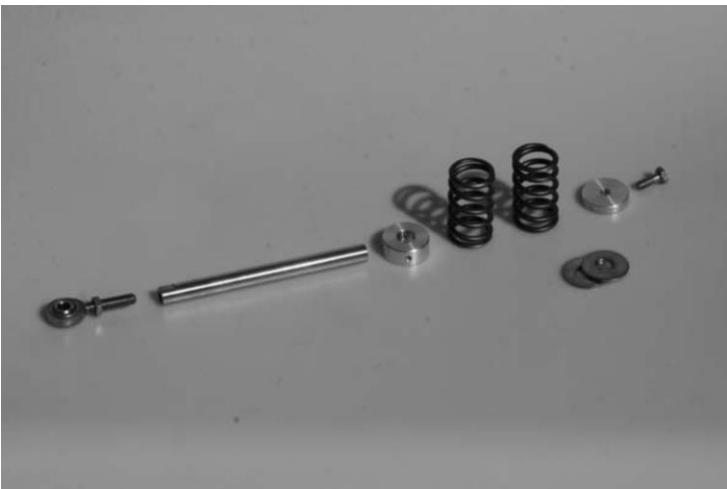
**Photo #22**

Top view of idler arm weldment in airframe.



**Photo #23**

Clean and grease the Nylatron bushings and the steel pivot spacer. Install the pivot bolt from the bottom and the nut on top. On final installation, torque the bolt to 12 ft. lbs. The idler pulley should be centered on the secondary pulley, and parallel with it both fore/aft and laterally. The arm should pivot freely with no breakout pressure or up and down movement.



**Photo #24**

Exploded view of the clutch tube assembly.

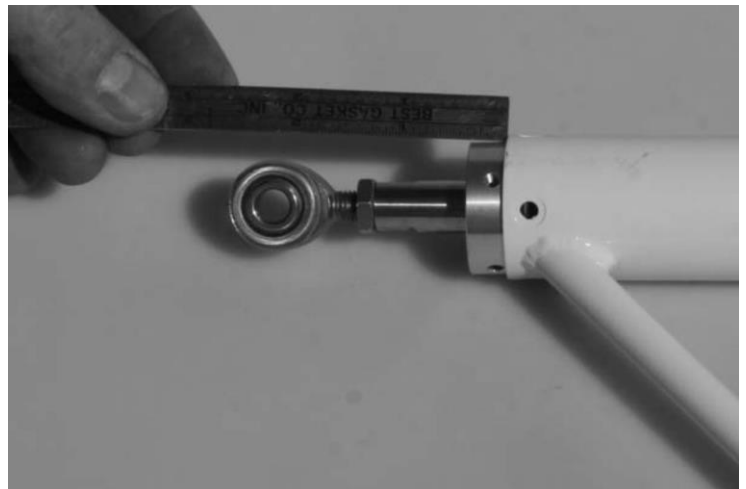
**Photo #25**

Install clutch spacer (E27-8610) onto the Clutch tube piston rod (E27-8400) with bolt (E00-2400). It is recommended that permanent Loctite 262 be used to secure the bolt. Install two clutch idler springs (E27-1210) over the shaft assembly. Slide the clutch piston guide (E27-8600) over the shaft on top of the springs.



**Photo #26**

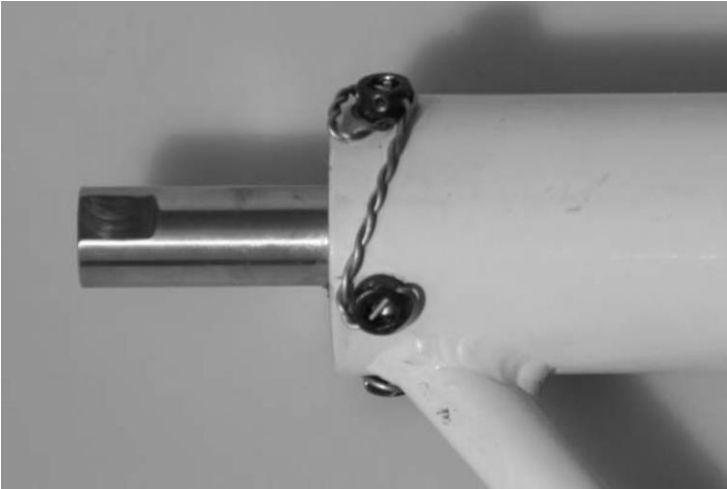
Slide the assembly into the clutch spring tube weldment (E27-8570). With the assembly touching the bottom, measure from the top of the clutch spring tube to the top of the clutch piston guide. The correct spacing for proper spring preload should be approximately 3/8".



**Photo #27**

If 3/8" spring preload is not measured install 7/16" fender washers as required between the spring and the clutch spring spacer.





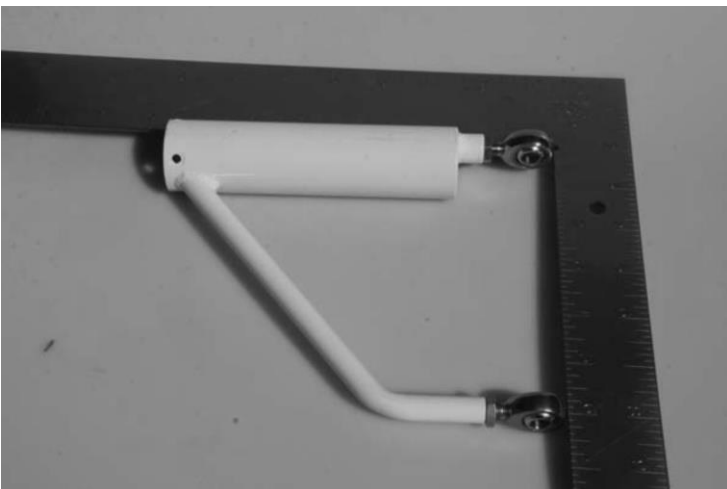
**Photo #28**

Prior to final assembly coat all of the internal parts with a light coat of grease. Install the four 8-32 socket head cap screws using Loctite on the threads. Then safety wire the screws as shown.



**Photo #29**

Install the rod ends into the spring tube weldment. The rod ends should be turned in approximately 3/4" and be parallel to each other.



**Photo #30**

Using a square against the top of the cylinder, check that both rod ends are positioned to form a 90 degree angle. Turn the top rod end in or out until a 90 degree angle is achieved.

Note: This angle should remain the same on final installation.

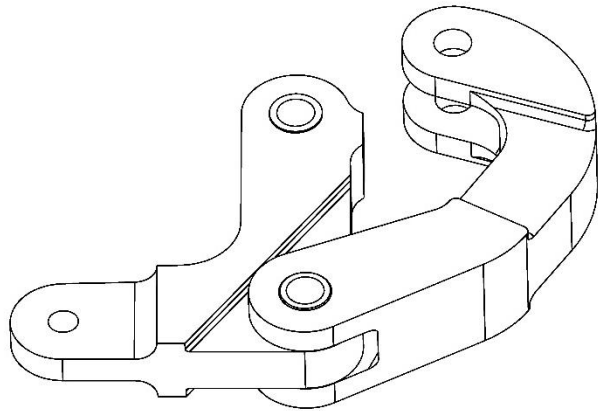
**Photo #31**

Install the clutch tube assembly on the idler arm. (For clarity, the parts are shown here removed from the airframe.)



**Photo #32**

Assemble the clutch linkages. The long end of the clutch pivot link (E27-8520) should go over the clutch pivot arm (E27-8530). The long clutch pivot link bushing (E27-8560) should be .005" to .015" longer than the width of the assembly. Trim accordingly.



**Photo #33**

Install non clevis end of the clutch pivot arm onto the airframe. The long clutch pivot link bushing (E27-8560) should be .005" to .015" wider than the link. Trim accordingly. Both pivots should rotate freely with minimal side play.





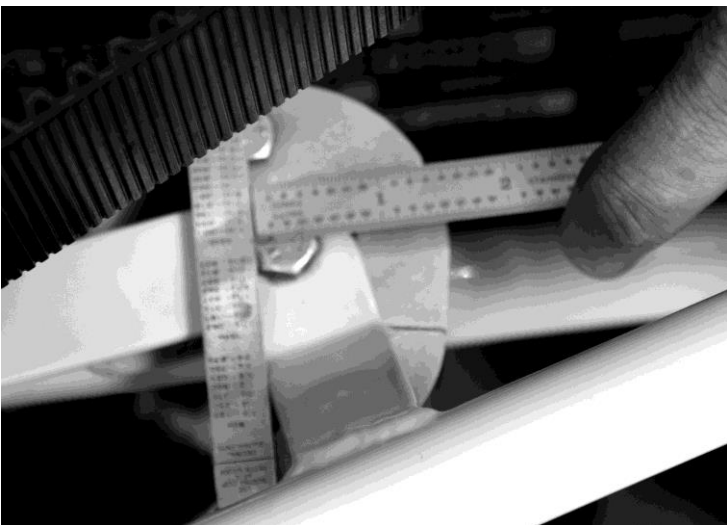
**Photo #34**

Adjust the rod end so there is 9-1/2" between rod end centers as shown.



**Photo #35**

The rod end from the clutch spring tube assembly should line up with the clevis end of the clutch pivot link in the engaged position. The bushing on the idler arm weldment can be adjusted or shimmed for up and down alignment. The rod end at the lower side of the idler pulley can be adjusted if the alignment does remain consistent as the clutch pivot link moves through its travel.

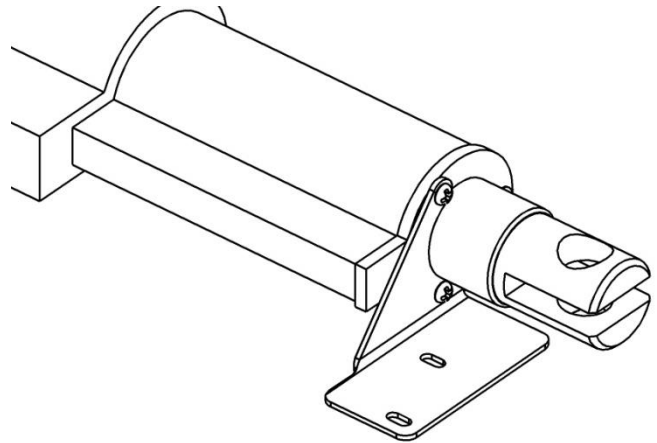


**Photo #36**

After attaching the rod end be sure that the clutch pivot link can collapse to an over center condition. Push the idler pulley to engage the belt. When the links are fully collapsed the pulley should remain engaged after you let go. If the pulley swings back out of engagement, you may need to trim the frame tab, the clutch pivot link, or the clutch pivot arm so the assembly has clearance in the locked position. The over center amount should be about 1/4". Lay a straight edge from the center of the two outside bolt heads and measure to the center of the center bolt head.

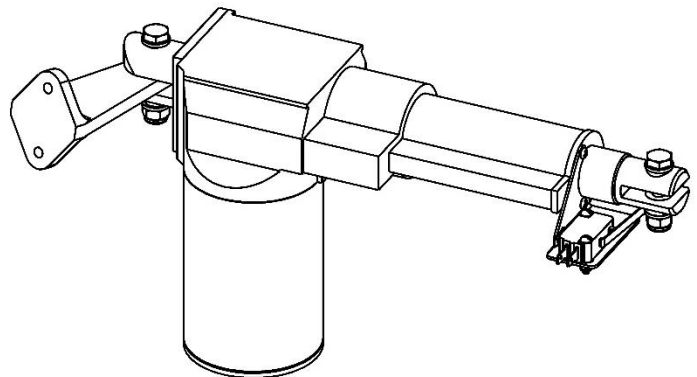
**Photo #37**

Using template E27-1, make the microswitch bracket from .050 aluminum. Attach the bracket to the actuator using 2 of the 3 existing screws on the actuator as shown.



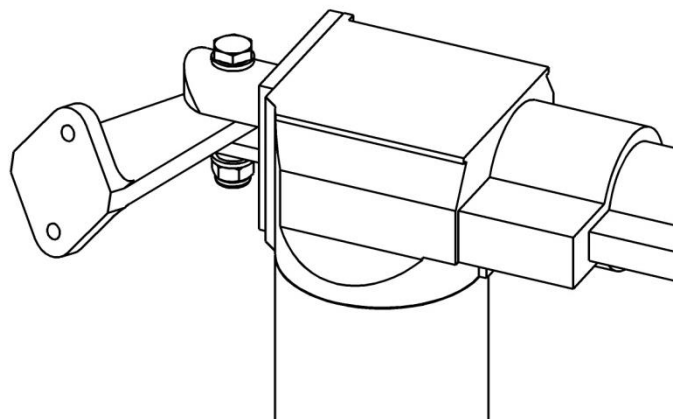
**Photo #38**

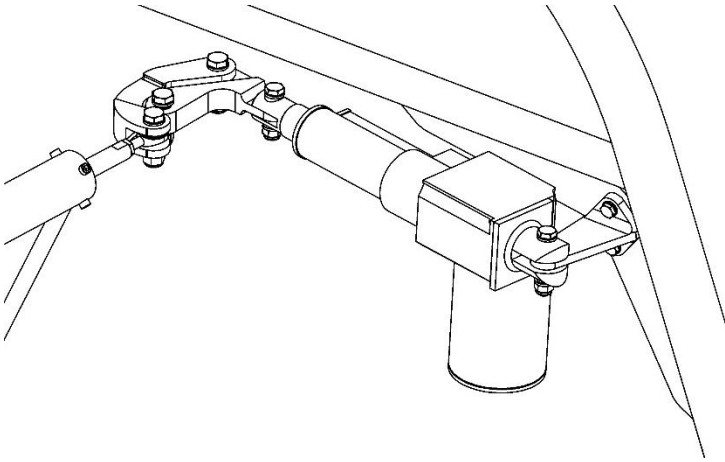
Attach the microswitch to the bracket. When the actuator is retracted, the lower bushing will press against the lever of the microswitch. An audible click from the switch can be heard.



**Photo #39**

Install the actuator frame mount on the actuator. Make sure there is enough clearance and no binding occurs when actuator pivots.





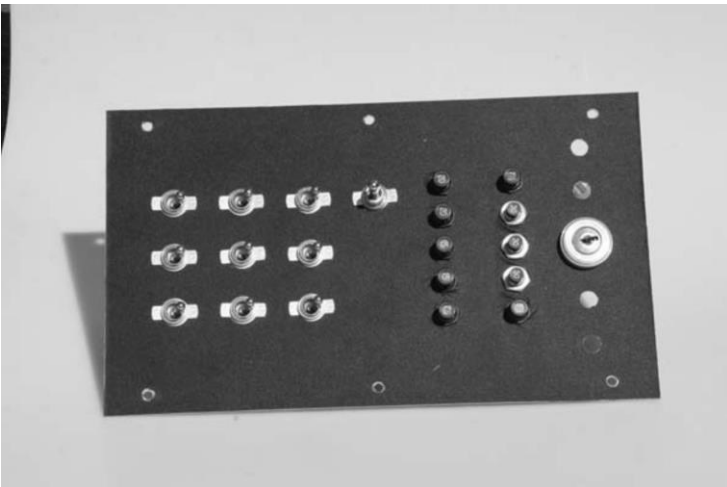
**Photo #40**

Install the actuator onto the clutch pivot link. Mark and drill mounting holes for the actuator on the airframe gusset. Be sure that the actuator is fully retracted, and that the clutch pivot link and arm is in the engaged position.



**Photo #41**

Belt tension with the clutch disengaged should be 10 lbs. with 3/4" belt deflection. Belt tension can be adjusted by moving the engine.



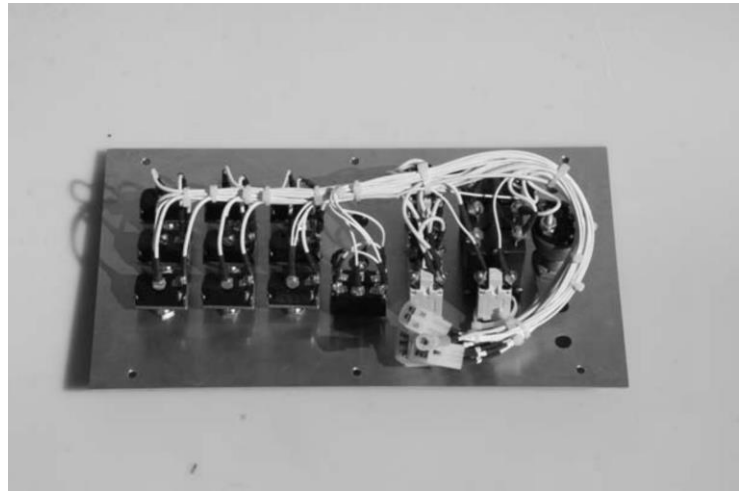
**Photo #42**

Mount the clutch toggle switch (E35-8242) in the overhead switch panel as shown. (E27 CARD 2T).



**Photo #43**

Wire the switch per the enclosed diagram (see last page of this section) and route the wires neatly as shown. The clutch wires should be terminated with a four pin Molex connector to aid servicing (E27 CARD 2T).



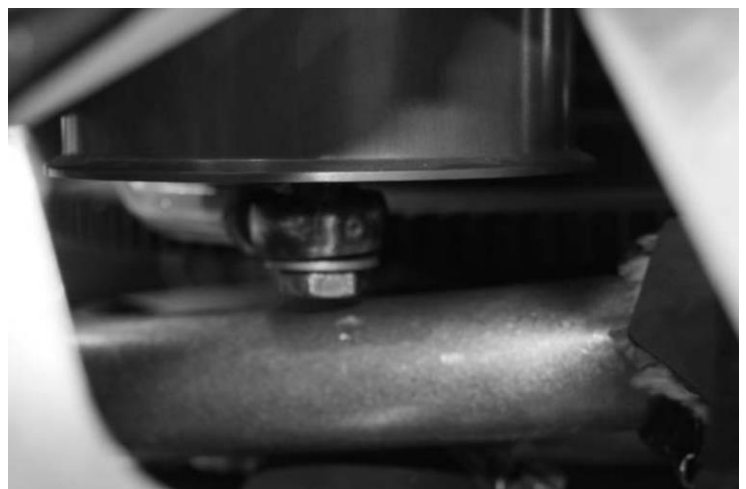
**Photo #44**

The clutch dash light will be 'ON' while the actuator is energized. To engage the clutch, flip the switch to the maintained position. To disengage the clutch, hold the switch in the momentary position for 5-10 seconds. Monitor this light periodically during flight to be sure it remains off. The wiring for clutch can be routed with the airframe harness.



**FINAL CHECKLIST**

1. Idler pulley should be parallel to secondary, both fore/aft and laterally. Idler pulley should be centered up/down on the secondary pulley. Belts should track in the center of the idler.
2. The bolt head on the bottom of the idler pulley should not contact the 1" water manifold on the engine. The water manifold and hoses can be adjusted forward on the engine for clearance if necessary (see photo).



WIRING DIAGRAM FOR ELECTRIC CLUTCH ACTUATOR

